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Mark Scheme (Results)

Summer 2014

Pearson Edexcel
GCSE in Engineering and Manufacturing
5EM03 3E
(Paper 3E: Electrical and Electronics, Process Control, Computers, Telecommunications)

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Publications Code

General Marking Guidance

- All learners must receive the same treatment. Examiners must mark the first learner in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Learners must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the learner's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a learner's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the learner has replaced it with an alternative response.
- Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:

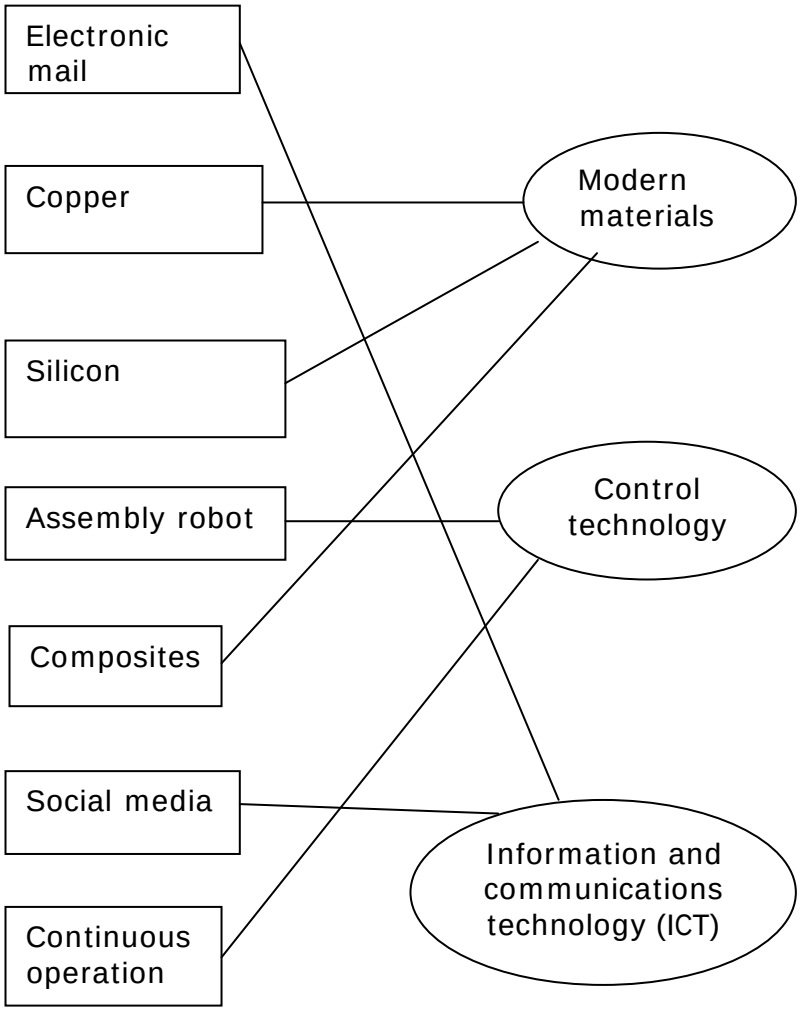
  i) Ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear

  ii) Select and use a form and style of writing appropriate to purpose and to complex subject matter

  iii) Organise information clearly and coherently, using specialist vocabulary when appropriate.

Question	Answer	Mark
1(a)	• Infrared keyboard • Smartphone *If 3 boxes or more crossed - no marks.* (2 x 1)	**(2)**
1(b)	• Hard drive • Smoke detector *If 3 boxes or more crossed - no marks.* (2 x 1)	**(2)**
		(Total 4 marks)

Question	Answer	Mark
2(a)	Accept any of the following answers: • Solder iron stand and sponge • Soldering iron stand • Solder stand • Solder iron holder • Iron stand *Do not accept 'stand' on its own* *Accept any recognisable spelling (phonetic) of the answer above* (1 x 1)	
	Accept any of the following answers: • Logic probe • Logic tester • Logic pulser • Level detector • Pulse detector • Detector *Do not accept 'probe ' on its own* *Accept any recognisable spelling (phonetic) of the answer above* (1 x 1)	**(2)**
2(b)	An answer that makes reference to two of the following points: • Acts as an amplifier of current • Semiconductor junction • Acts as a switch • Switches circuit on or off *Accept any other appropriate response* e.g. Acts as a switch(1) to turn circuit on (1) (1 x 2)	
	An answer that makes reference to two of the following points: • Acts as a filter • Stores energy • Current flow produces magnetic field • Passive electrical component • Resists change in DC current *Accept any other appropriate response* e.g. Stores energy (1) by current flow producing a magnetic field (1) (1 x 2)	**(4)**
		(Total 6 marks)

Question	Answer	Mark
3	Key terms linked to a key area **Key Term** **Key Area**  *No mark awarded where 2 or more lines are drawn from a term. Lines do not have to be straight but term and key area must be clearly linked.* (7 x 1)	**(7)**
		(Total 7 marks)

Question	Answer	Mark
4(a)	Appropriate **products** such as e.g. • Heat gun • DVD player • Tablet • TV • Smartphone • Vacuum cleaner • Automatic kettle • MP3 player • Fire alarm • Smoke alarm • Plug top • Portable drill • Circular saw • Motor starter • Broadband devices • A brand name of any other specific product *This list is not exhaustive; accept any product associated with the electrical, electronics, process control, computers, telecommunications sector that uses control technology and a soldering process in its manufacture.* (2 x 1)	**(2)**
4(b)(i)	• Process control • Computer Integrated Manufacturing (CIM) • Robotics • Programmable logic controllers (PLCs) • Automation • Continuous operation • Embedded computers • Thermostat • Computer Aided Manufacture (CAM) • Automated conveyors *Accept any appropriate response* Accept specific machines such as 'injection moulding', 'laser cutting', 'robots', 'conveyor belts', 'CNC machines'. Do not accept 'CAD' without CAM links. (1 x 1)	**(1)**

Question	Answer	Mark
4(b)(ii)	1 mark for identifying reason (x2), 1 mark for why (x2), e.g. Process control • Waste control (1) – as monitors processes and quality control of processes (1) • Product consistency (1) – as better control of processes (1) • Energy conservation (1) – as tighter control of energy into process (1) Robotics • Product consistency (1) – as better control of processes (1) • Efficiency (1) - as less waste/faulty parts (1) • Competitiveness (1) – as faster rates of production (1) Automation • Speed (1) – as faster than human application (1) • Cost control (1) – as less waste/faulty parts (1) • Product consistency (1) – as better control of processes (1) Computer Aided Manufacture (CAM) • Competitiveness (1) – as faster rates of production through application of CAM techniques (1) • Efficiency (1) – as less waste/faulty parts (1) • Product consistency (1) – as better control of processes (1) *Accept any appropriate response* *No answer or incorrect answer to 4(b)(i) no marks for 4(b)(ii)* *Low response (1) or two low responses (2) or detailed response (2), for each of the 2 reasons* (2 x 2)	**(4)**
4(c)(i)	Appropriate soldering process suitable for Product 1, e.g. • Hand soldering - (electronic circuit boards) • Silver soldering - (silver contacts on pcbs) • Induction soldering - (coils and transformers) • Wave soldering – (SMT) • Reflow soldering -(SMT and through hole mounted) • Resistance soldering –(motor starter/plug top) • Laser soldering – (SMT and miniaturised pcbs) • Fibre focus infrared soldering - (telecoms/broadband) (1 x 1)	**(1)**
4(c)(ii)	Any 2 appropriate points stated: **Hand (Soft) soldering** In this soldering process, heat is applied to the parts to be joined (1), causing the solder to melt (1) and to bond to the work-piece (1) in an alloying process called 'wicking' (1). The joint strength is dependent on the filler metal used (1). Soldering produces electrically-conductive (1), and water- and gas-tight joints (1). **Wave soldering** parts are temporarily kept in place with small dabs of adhesive (1), then the assembly is passed over flowing solder in (1) a bulk container. This solder is shaken into waves so the whole PCB is not submerged in solder (1), but rather touched by these	**(2)**

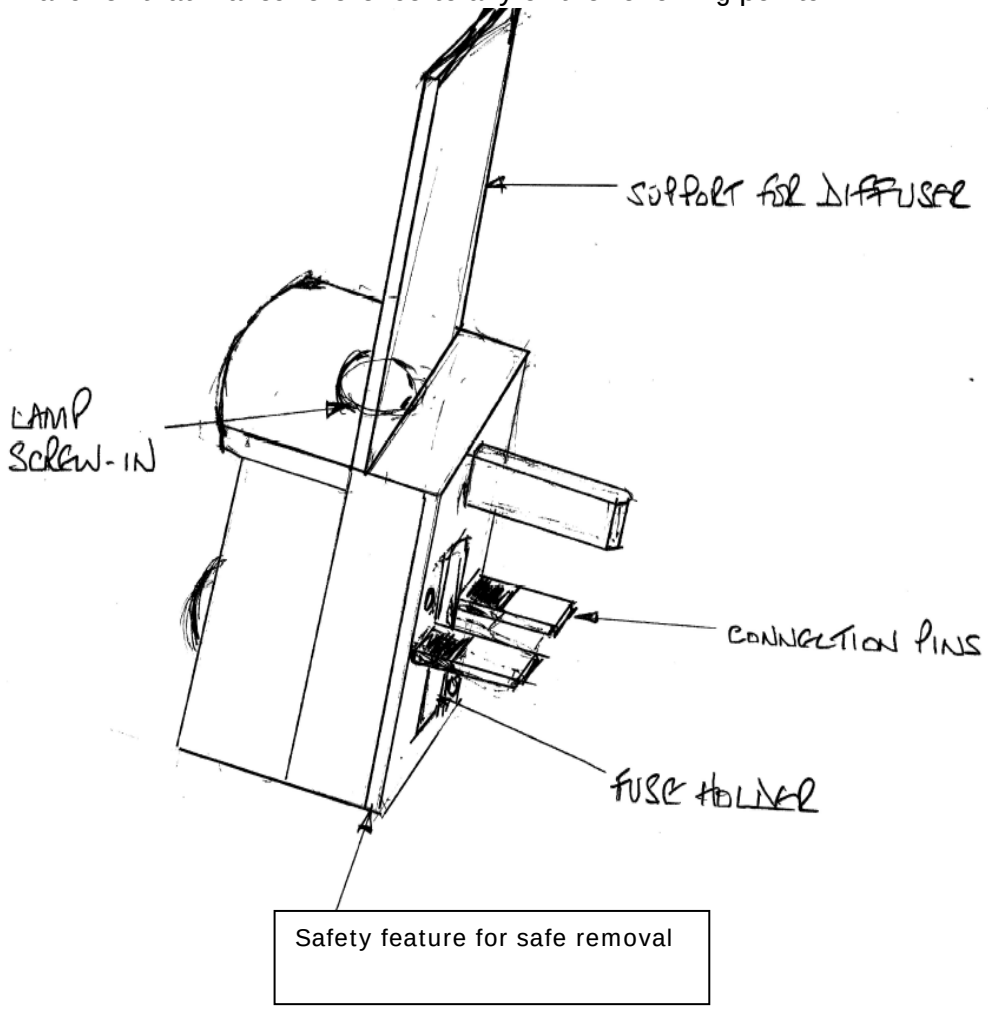
Question	Answer	Mark
	waves. The end result is that solder stays on pins and pads (1), but not on the PCB itself. Soldering produces electrically-conductive (1), water- and gas-tight joints (1). **Reflow soldering** is a process in which a solder paste (1) is used to stick the components (1)to their attachment pads(1), after which the assembly is heated(1), by passing it through a carefully controlled oven(1). Soldering produces electrically-conductive (1), water- and gas-tight joints (1). **Laser soldering** –is a technique where a 30 to 50 W laser(1)is used to melt and solder an electrical connection(1) Diode laser systems based on semiconductor junctions are used for this purpose.(1) The beam is delivered via an optical fibre1) to the work-piece, with fibre diameters 800 µm and smaller(1) Lenses are used to create a suitable spot size on the work-piece (1). A wire feeder is used to supply solder (1). **Resistance soldering** where heat is produced within an element (1) and then passed through a thermally conductive tip (1) into the joint area (1). Allows a faster ramp up to the required solder melt temperature (1). Heat is only produced while each joint is being made (1), making resistance soldering more energy efficient (1). Produces a sound electrical connection(1) and a tough mechanical joint(1) *Accept any appropriate response; no marks for repeating the process named* *Low response (1) or two low responses (2) or detailed response (2)* (1 x 2)	
		(Total 10 marks)

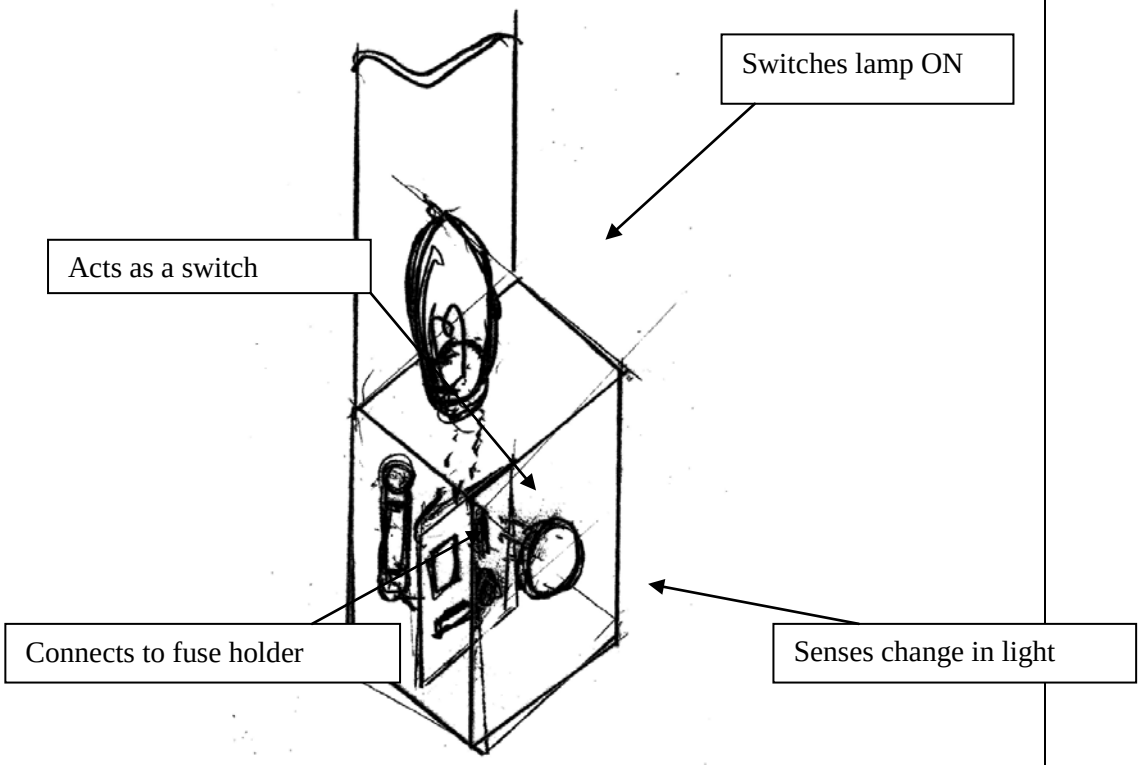
Question	Answer	Mark
5(a)	1 mark for example, 1 mark for extension • Publicising employment opportunities (1) reduces recruitment costs (1) • Easier to research competition (1) reduces design/marketing labour costs (1) • Direct advertising of products (1) minimises need for printed materials, telemarketing etc (1) • Direct sales of products (1) reduces administration costs (1) • Finding suppliers to order materials (1) easily accessible audit trail (1) • Access to progress of order [as customer or seller] (1) more accurate scheduling/management of supply chain or reduced post sales costs (1) *Accept any appropriate response* Accept responses that reference specific types of cost reduction. *Low response (1) or two low responses (2) or detailed response (2)* (1 x 2)	**(2)**
5(b)	1 mark for identifying a benefit (x3), 1 mark for how (x3) • reduced ordering times (1) – automatic monitoring (1) • improve quality/accuracy/ consistency (1) – control of processes (1) • reduced wastage (1) – optimise production methods (1) • improved efficiency (1) – faster/quicker throughput (1) • better process control (1) – in process monitoring (1) • reduced labour (1) – automated processes (1) • lower costs (1) – reduced wastage/faster/continuous production (1) • safer processes (1) – less manual input (1) *Accept any appropriate response* *No repetition* *Do not accept 'easier', or 'faster/quicker' without description, e.g. its quicker and more accurate (1)) –mark awarded for 'more accurate'* *Low response (1) or two low responses (2) or detailed response (2), for each of 3 benefits* (3 x 2)	**(6)**
		(Total 8 marks)

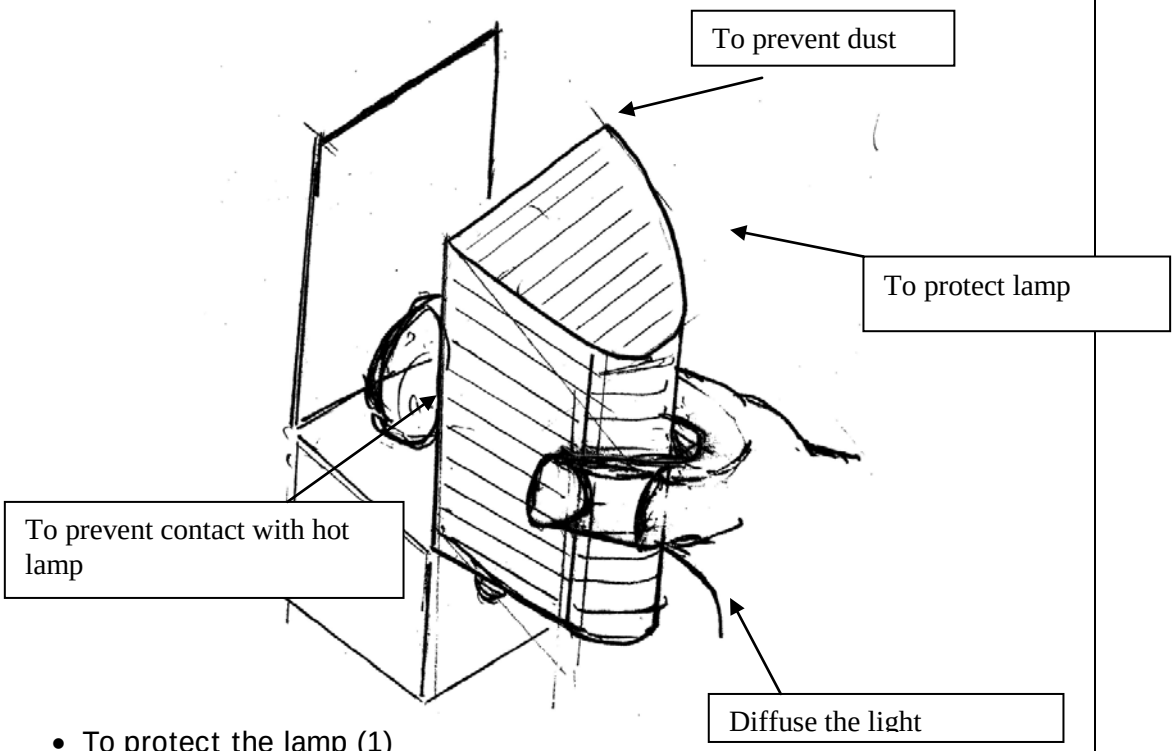
Question	Answer	Mark
6(a)(i)	• Mobile phone/infrared/bluetooth • Internet/wireless/Wi-Fi • Video conferencing • Video calling • Voice over Internet Protocol (VoIP) • Electronic point of sale (EPOS) • EDI • ISDN • Texting • Phone • Walkie talkie • Fax • Smart TV • Smart phone • Tablet • Computer *Accept brand names eg 'Skype' or 'facetime'* *Accept any appropriate response* *Do not accept: CAD/database/spreadsheet/telecommunications/search engines eg 'google'* *Do not accept 'TV' on its own* (2 x 1)	**(2)**
6(a)(ii)	1 mark for example (x2) and 1 mark for extension (x2) • To clarify customer requirements (1) so mistakes are not made (1) • To request a product specification/drawings (1) so tools/equipment can be prepared (1) • To contact suppliers (1) so they can order materials/equipment (1) • To communicate information to schedulers (1) so they can reorder work (1) • To update the customer on progress (1) to ensure they are satisfied (1) • To provide the customer with dispatch information (1) so they are able to prepare for receipt of the products (1) *All the answers must relate to the requirement for the products to be made urgently and to the manufacturer* *Low response (1) or two low responses (2) or detailed response (2), for each of the 2 examples* (2 x 2)	**(4)**
6(b)(i)	• Photochromic inks • Holographic card • Shape memory alloys • Smart wire • Nitinol • Smart springs • Magneto/Electro-Rhological Fluids	

Question	Answer	Mark
	• Cold forming polymers • Phosphorescent pigments • Thermochromic inks • Polymorph • Piezoelectric • Quantum Tunnelling Composite/QTC *Accept any appropriate response, but smart material must be related to the sector* (1 x 1)	**(1)**
6(b)(ii)	1 mark for reason, 1 mark for why • To improve appearance of the material (1) in order to attract customers (1) • To waterproof the material (1) in order to reduce damage (1) • To protect the material (1) in order to improve product lifespan (1) • To change/enhance the properties of the material (1) in order to add value (1) • To meet customer requirements/standards/specification (1) to ensure it is fit for purpose (1) Do not accept a type of finish without a suitable explanation. *Low response (1) or two low responses (2) or detailed response (2)* (1 x 2)	**(2)**
		(Total 9 marks)

Question	Answer	Mark
7(a)	1 mark for identifying benefit, up to 2 marks for extension • Accurate information (1) – instant feedback (1) so more responsive to customer needs (1) • Detailed customer information (1) – tailoring product to target market (1) in order to match customer requirements (1) • Information for strategies/campaigns (1) – choosing correct media (1) for target customer (1) • Information for advertising campaigns (1) – modelling sales versus demand (1) allowing the use of correct parameters (1) • Profit/loss information available (1) – can be shown in graphical form (1) therefore easy to see where sales efforts should be targeted (1) • Ordering to meet sales faster (1) – repeat purchases (1) and production set up based on sales data (1) *Accept any other appropriate response* *Low response (1) or detailed statement (3)* (1 x 3)	**(3)**
7(b)	1 mark for identifying benefit, up to 2 marks for extension • Accurate information (1) – updated regularly (1) so production status clear (1) • Detailed information (1) – high storage space (1) so production data can be interrogated over a variety of time periods (1) • Fast access to data (1) – search/sort/query (1) enables ability to isolate production issues (1) • Improved planning (1) – shorter lead times (1) therefore faster throughput (1) • Forecasting (1) – collects volumes of data/modelling (1) so forward planning is more accurate (1) • Cost of control (1) – better scheduling (1) enabling lower overheads (1) • Waste control (1) – process monitoring/control (1) highlighting QC issues (1) • Reduced stock holding (1) – tracks trends/JIT [Just-In-Time] (1) improving efficiency in the supply chain (1) • Training records (1) – skills monitoring (1) so deployment more efficient (1) *Accept any other appropriate response* *Low response (1) or detailed statement (3)* (1 x 3)	**(3)**
		(Total 6 marks)
	Total Marks for Section A	**50**

Question	Answer	Mark
8(a)	An answer that makes reference to any of the following points:  • To provide screw connection for lamp (1) • Allows for connection to the mains (1) • To provide fuse protection for the lamp (1) • To hold the fuse (1) • To provide support for the diffuser / lamp cover (1) • To hold the LDR circuit (1) • Safety design to allow safe removal from mains (1) *Accept any other appropriate response* *Answer must contain both notes and sketches.* *Max **two** marks if only notes or only sketches used.* (3 x 1)	**(3)**

Question	Answer	Mark
8(b)	An answer that makes reference to any of the following points:  • To monitor change in light level (1) • Changes resistance with light level (1) • To act as a switch (1) • To turn the circuit on or off (1) • Switches on the lamp (1) • Connects to fuse holder (1) *Accept any other appropriate response* *Answer must contain both notes and sketches.* *Max **two** marks if only notes or only sketches used.* (3 x 1)	**(3)**

Question	Answer	Mark
8(c)	An answer that makes reference to any of the following points:  • To protect the lamp (1) • To act as a dust cover (1) • To act as a diffuser to spread the light(1) • To give an even spread of light (1) • To prevent contact with hot lamp (1) • Easy to remove to change the lamp(1) *Accept any other appropriate response* *Answer must contain both notes and sketches.* *Max **two** marks if only notes or only sketches used.* (3 x 1)	**(3)**
		(Total 9 marks)

Question	Answer	Mark
9(a)(i)1	• Marketing (1 x 1)	
9(a)(i)2	• Assembly and finishing • Finishing and assembly • Assembly • Finishing (1 x 1)	**(2)**
9(a)(ii)	• Design • Stage 1/stage one • One/1 • First/ First stage (1 x 1)	**(1)**

Question	Answer	Mark
9(b)	• Checking availability of suitable materials/bought-in consumables(1) • Purchase of suitable materials/ bought-in consumables((1) • Sourcing of materials/ bought-in consumables (1) • Price negotiation (1) • Good inwards inspection/testing (1) • Quality control checks (1) • Coding checks (1) • Storage of materials/consumables (1) • Progress chasing (1) • Stock taking / keeping (1) *Accept any other appropriate response* (3 x 1)	**(3)**

Question	Answer	Mark
3(c)	Appropriate descriptions including three of the following points (statements must be applicable to the night light): • Scheduling production (1) • Converting order to production (1) • Materials requirements (1) • Labour requirements (1) • Deadlines (1) • Throughputs (1) • Machinery/equipment requirements (1) • Quality check requirements (1) • Specifying control points (1) • Health and safety requirements (1) • Storage requirements (1) *Accept any other appropriate response* e.g. The stage where the manufacturer decides how the product is going to be made (1), what materials are needed (1) and what processes will be used during manufacturing (1). e.g. The stage where the specification for the night light is used by the planning team to set out all operations (1) and to schedule (1) the night light through the production/processing department to meet the required delivery deadlines (1). This could include specifying any special materials or consumables (1) and stating machinery requirements (1). *3 x 1 mark for 3 low responses or up to 3 for a detailed response* (1 x 3)	**(3)**
		(Total 9 marks)

Question	Answer	Mark
10(a)	• Acrylic • PVC • Polycarbonate • Styrene • ABS *Any other appropriate response* *Do not accept 'plastic' on its own* (1 x 1)	**(1)**
10(b)(i)	Any three of the following: • Extrusion • Injection moulding • Blow moulding • Forging • Compression moulding • Wave soldering • Reflow soldering • Embossing • SMT • Pick and place • Drilling *Any other appropriate response* *Do not accept 'Vacuum forming'* *Do not accept 'moulding' or 'soldering' on its own.* *Accept any recognisable spelling (phonetic) of the answers above* (3 x 1)	**(3)**

Question	Answer	Mark
10(b)(ii)	An explanation that makes reference to three of the following points: • relatively inexpensive moulds/much cheaper tooling than other forming methods • durable moulds/can be replaced infrequently • quick changeover rate/easy to change mould • flexibility for different shape/size/gauge/colour of cover • quick method to produce 3D shapes • can be mass produced easily • unit costs are very low for medium to high volume production runs • highly automated process • reliable process • minimal waste • not labour intensive • products have consistent quality • can have multiple parts • Suitable process for the material used for the cover e.g. Highly automated process (1) allowing products to be mass produced easily (1) with a consistent quality (1) *Accept any other appropriate response* *Do not accept 'easier', or 'faster/quicker' without qualification* *3 x 1 mark for 3 low responses or up to 3 for a detailed response* (1 x 3)	**(3)**
10(c)	An explanation that makes reference to three of the following points: • materials are less likely to be made from non-renewable/finite resources • materials can be bio-degradable • materials take less processing in manufacture • materials consume less energy in manufacture • smaller volume of material is used • materials have good wear resistance so less wastage or need for replacement • materials can be recycled *Do not accept generic responses such as 'less global warming' or 'less CO_2' without qualification* *3 x 1 mark for 3 low responses or up to 3 for a detailed response* (1 x 3)	**(3)**
		(Total 10 marks)

Question	Answer	Mark
11(a)(i)	Any two of the following: • Drafting possible solutions/final design drawings • Modelling/editing possible solutions/final designs • Conversion from 2D to 3D • Use of websites/internet to investigate existing designs • To source materials/supplies/consumables • Costing resource requirements • To communicate with client/customer • Easy storage and retrieval of data/information • Interaction with databases • Calculation of weight/strength characteristics *Accept any other appropriate response* *Do not accept software package names eg '2D design', 'autocad', 'sketch up' on its own.* *Do not accept a type of ICT without an appropriate link to one of the above points.* *No repetition* (2 x 1)	**(2)**
11(a)(ii)	1 mark for identifying the use (x2), 1 mark for how (x2) • Development of labelling (1) and/by electronic tagging protocol (1) • Electronic monitoring (1) of some packaging processes (1) • Use of bar codes (1) to monitor packaging/dispatch of night light packaging (1) • Interrogating customer orders (1) so deliveries can be batched together (1) • Use of software (1) to record/log output of night light packaging (1) • Real time dispatch and delivery information (1) in order to raise invoices (1) *Accept any other appropriate response* *Low response (1) or two low responses (2) or detailed response (2)* (2 x 2)	**(4)**
11(b)	1 mark for identifying the benefit, 1 mark for how • Establishes a market database (1) shared with the manufacturer (1) • Has accurate costing information (1) shared with the manufacturer (1)/that can be manipulated easily (1) • Gives distributors the opportunity to match customer needs	**(2)**

Question	Answer	Mark
	(1) with production of night lights (1) • Gives distributors fast sales data (1) possibly leading increased sales/profits (1) • Accurate sales data (1) leads to accurate pricing (1) • Advertising/selling online (1) leads to wider market (1) • Assists with stock rotation (1) leading to less waste (1) • Navigation software (1) enables route planning to reduce costs (1) • Efficient tracking/monitoring (1) leads to fewer product losses (1) *Accept any other appropriate response* *Low response (1) or two low responses (2) or detailed response (2)* (1 x 2)	
11(c)	An answer that makes reference to any of the following points with explanation: • Fast time to market for latest types of night lights • Use of ICT in market research enables manufacturer to match new types of night light to market want/needs • Function/style information available for whole design team • Speed/efficiency of modelling • Modification of ideas • Improved aesthetics • Ease/speed of creating virtual products • On screen design ideas • Speed of decision making by client • Easy access to design data • Working drawings/manufacturing specifications available for whole team • Easy access to manufacturing information in company database • Manufacturing time not wasted • Efficiency of costing materials • Speed of decision making for design team/client • Allows best materials to be used • Appropriate use of database • Modelling ensures characteristics are fit for purpose • Production processes are controlled better *Accept any other appropriate response* *Up to 4 low responses (4) or detailed response (up to 4)* *e.g.'s* *ICT allows for conversion from 2D to 3D (1) which means designs*	**(4)**

Question	Answer	Mark
	can be modelled virtually (1) and then tested for development purposes onscreen (1). Resource requirements can also be planned from the virtual model (1). *Modelling ensures characteristics are fit for purpose (1) as it allows fast product development (1) as a result of creating virtual products (1), speeding up the decision making process between client and design team (1).* *Manufacturing time is not wasted (1) as decisions made by the client are quicker (1). This gets products to market faster (1), therefore increasing sales (1).* *Responding to the client's modification of ideas (1) allows modelling (1) of change and ensures efficiency of costing materials (1) and manufacturing time not wasted (1).* *ICT gives easy access to a range of design data (1) which means updating of drawings can be effectively carried out (1) and when linked to the production department, can change the requirements of operations (1) in production without lengthy delays (1).* *ICT has allowed new designs for night lights to reach the market more quickly (1) as the design, development and production processes have become faster. Onscreen design ideas (1) can be modified (1) quickly and can easily be converted into a 3D model (1).* (4 x 1)	
		(Total 12 marks)

Question	Answer	Mark
12(a)	1 mark for identifying effect (x2), 1 mark for extension (x2) • Workforce will be smaller in size (1) resulting in increased competition for fewer jobs (1) • Workforce will be better educated (1) as higher level of development skills required (1) • Less physically demanding tasks (1) but increased flexibility in work patterns [shifts] (1) • Less employment for unskilled (1) as constant need to retrain (1) • Team working more important(1) due to increased specialisation (1) • Improved promotion prospects for those in post (1) as skills in demand (1) *Accept any other appropriate response* *Low response (1) or two low responses (2) or detailed response (2)* (2 x 2)	**(4)**
12(b)	1 mark for identifying benefit (x 2), 1 mark for extension (x2) • Cleaner (1) – tidier processing/contained processing (1) • Safer (1) – automation can self regulate/work less likely to be done by humans/machines do not tire and become dangerous (1) • Quieter/reduction in noise pollution (1) – soundproofing possible as processing can be enclosed (1) • Healthier (1) – processes can monitor the environment and react accordingly (1) *Accept any other appropriate response* *Low response (1) or two low responses (2) or detailed response (2)* (2 x 2)	**(4)**
12(c)	Any 2 appropriate points stated: • Possible production throughput/quantities achievable with increased automation • Probable energy usage with increased automation • Cost of installing new automation • Cost of commissioning new automation • Operational costs of new automation • Maintenance costs due to complexity of automation • Product quality achievable with new automation • Product range achievable with new automation • Customer satisfaction achievable with new automation • Increased emissions/noise pollution due to increased automation	**(2)**

Question	Answer	Mark
	Accept any other appropriate response *Do not accept responses associated with the workforce or the working environment* (2 x 1)	
		(Total 10 marks)

Question	Answer	Mark
13	An answer that makes reference to any of the following points with explanation: • Collection and reuse of exhaust/vented gasses generated during production • Collection and reuse of conduction/convection/radiation heat generated during production • Collection and reuse of heat collected by cooling/ventilation systems • Use of Combined Heat and Power systems • Use of heat exchangers/heat sinks • Improving the energy efficiency of the heat generating process • Pre-heating to reduce energy usage • Heating other production processes, eg preheat moulding • Space heating • Heating water • Selling renewable electricity back to the National Grid • Absorption refrigeration e.g. The manufacturer of night lights could use systems to collect and reuse heat from production processes (1), and these systems could pre-heat the same process (1), or the waste from processes could be used to heat water (1) in the production plant, all to save energy and money (1). *Any other appropriate response* *Up to 4 low responses (4) or detailed response (up to 4)* (1 x 4)	**(4)**
		(Total 4 marks)

Question	Answer	Mark
14 **QWC i, ii,** **iii**	**Indicative content** Discussion may address the following issues: • *Benefit* ▪ Efficient manufacturing system • *Development* ▪ Introduction of a pull system ▪ Highly responsive to customer demand, as products can be manufactured as and when required ▪ Production controlled by 'kanbans', hence manufacture not regarded as 'fixed' to a certain number ▪ Errors dealt with as and when they occur, as issues with 'upstream' processes have a visible effect on 'downstream' processes • *Benefit* ▪ Integrated supply chain • *Development* ▪ Collaboration with suppliers results in productivity improvements along the supply chain ▪ Reduced number of 'key' suppliers with a greater interest in ensuring the flow of completed product ▪ Improved accountability/traceability, as defective product is easily identifiable • *Benefit* ▪ Reduced inventory • *Development* ▪ Minimises the cost of storing raw materials/'work in progress'/finished goods, as all arrive at the right place when required ▪ Reduces the need for storage space, as a higher percentage of floor area can be used for 'value adding' activities ▪ Product obsolescence is highly unlikely, hence negligible percentage of unsold stock • *Benefit* ▪ Multi-skilled employees • *Development* ▪ Employees are trained to complete a variety of tasks, so they can be deployed to ensure the smooth flow of production ▪ Improved motivation, as variety in daily work ▪ Workers empowered to suggest/implement improvements *Any other appropriate response* Example learner answer (Level 3): Just-in-time saves money by reducing inventory thus reducing the cost of storing raw materials and finished goods, as they	**(6)**

	should all arrive at the right place when required. This reduces the need for expensive storage space, so a higher percentage of floor area can be used for value adding activities, and simple kanbans can be used to signal when work in progress is ready for the next operation to be carried out. Because everything needs to happen smoothly and just-in-time, problems are very obvious and have to be dealt with there and then, and cannot be hidden. This means workers are generally multi-skilled, so they can go to the place in the factory that they are needed most to ensure the smooth flow of production.	
		(Total 6 marks)

Level	Mark	Descriptor
	0	No material deserving of reward
1	**1-2**	The learner identifies at least two benefits of using 'just-in-time' techniques or gives a brief description of one benefit, and shows some understanding of the topic. The learner uses everyday language and the response lacks clarity and organisation. Spelling, punctuation and the rules of grammar are used with limited accuracy.
2	**3-4**	The learner gives a brief description of at least two benefits of using 'just-in-time' techniques or a detailed description of one benefit. The learner uses some manufacturing/technological terms and shows some focus and organisation. Spelling, punctuation and the rules of grammar are used with some accuracy. Some spelling errors may still be found.
3	**5-6**	The learner gives a detailed explanation of at least two benefits of using 'just-in-time' techniques. The learner uses a range of appropriate manufacturing/technological terms and shows good focus and organisation. Spelling, punctuation and the rules of grammar are used with considerable accuracy.
		(Total 6 marks)

Total Marks for Section B	**60**
Total Marks for the whole paper for Section A & B	**110**

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